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ABSTRACT

To determine the current status of science education within special education school programs for students with mild disabilities, survey data were collected from over 300 teachers. Analyses focused on whether science was in fact being taught and, if so, the amount of instructional time devoted to it, the curricular basis and teaching approaches being used, and the training backgrounds of special education teachers. Many teachers (42 percent) reported having had no training of any type in science education methodology. Insufficient materials and time were cited as the major hindrances to inclusion of science education in special education settings. Almost half the teachers were found to be using a combination of instructional strategies such as textbook learning and hands-on activities; the hands-on approach was found to be much less common in special education classes. Results are discussed in terms of their implications for students with disabilities and possible directions for future research and practice. (Contains 15 references.) (PB)

Science Education for Students with Mild Disabilities: A Status Report

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ABSTRACT

Science has frequently been seen as an overlooked instructional area for students with various learning-related problems (i.e., learning disabilities, mild mental retardation, mild behavioral/emotional disorders). To determine the current status of science education within special education school programs, survey data were collected from over 300 teachers. Analyses focused on whether science was in fact being taught and, if so, the amount of instructional time devoted to it, the curricular basis and teaching approaches being used, and the training backgrounds of special education teachers. The results are discussed in terms of their implications for students with disabilities and possible directions for future research and practice.

Science Education for Students with Mild Disabilities: A Status Report

Educators have long recognized that students typically are curious about their surroundings and, as a result, have a natural interest in seeking information about and from their environment. This curiosity and interest, along with the relevance of specific topics, can provide the basis for instruction in the area of science. Nevertheless, science has often been given low priority status in educational programs of students with mild disabilities (i.e., learning disabled, mild mentally retarded, behaviorally/emotionally disordered). Price, Ness, and Stitt (1982) have speculated that this status is caused by "the emphasis on the development of basic skills which has been an all-consuming effort in many programs for the mildly handicapped" (p. 363).

In addition to the above concern, personnel preparation programs for special educators have frequently neglected this area, with relatively few training programs including courses or course modules on teaching science to special populations (Polloway, Payne, Patton, & Payne, 1985). As a consequence, anecdotal observations have indicated that many teachers feel unprepared and uncomfortable to teach this subject. For many secondary level special education teachers this is especially problematic because these instructors are often assigned to teach within this

curricular domain and must function as subject area specialists.

Only a few papers in the literature have addressed science instruction for students with mild disabilities (e.g., Cain & Evans, 1984; Jacobson & Bergman, 1980; Keller, 1981; Menhusen & Gromme, 1976). Various reasons have been used to explain why science should not be taught to these students: content and methodology are not appropriate; concepts are too difficult; students are not interested; and students can not manipulate science equipment and material. On the other hand, professionals who have become interested in providing science instruction to special populations have countered that these reasons are unfounded and have offered strong arguments why science should be taught to students with special needs.

Little information can be gleaned from the literature as to the current status of science education for special populations. While increasing attention is being given to the fact that a significant number of mildly handicapped students are being mainstreamed into regular education science classes, virtually no descriptive data exist in regard to the nature of science education programming in special settings. Price, Ness, & Stith (1982) have suggested that special learners in self-contained classes (classes in which students spend most of their instructional day) should be receiving some form of science instruction. They also accurately note that it will be unlikely for students in resource settings (classes in which students typically spend only a few hours of their instructional day) to do so. Nevertheless, Keller (1981)

stated that resource teachers might be able to coordinate some of their efforts with those of regular education teachers who are teaching science to students in regular education settings.

There is no generally agreed upon amount of time per week which should be allotted to science instruction. However, most states have set certain guidelines in this area. For instance, Bindel (1985) reported on the current status of regular science education in various states throughout the country. One of the variables which was examined was the amount of time that is supposed to be given to science instruction each week; as a rule, this amount of time increases with grade level. As examples of what Mindel reported, the guidelines for three states are illustrative: Minnesota--(K-3) 85 minutes per week, (4-6) 130 minutes per week; Texas--(1-3) 100 minutes per week, (4-6) 225 minutes per week; Virginia--(K-3) 100 minutes per week, (4-6) 150 minutes per week, (7-8) 250 minutes per week. Although these figures are associated with regular science education, they serve as guidelines for the amount of time which should be devoted to science education in many special education settings as well.

Different approaches exist for providing science instruction to students. The National Science Teachers Association (Teters, Gabel, & Geary, 1984) surveyed regular elementary science teachers across the country. Many questions were asked-one of which was "what are the three most commonly used methods of instruction in your science classroom?" The teachers who responded indicated that most of them employed a hands-on approach. Interestingly, most

instruction occurs in a large group format, suggesting that this hands-on methodology was probably being accomplished through demonstration. Textbooks are utilized more frequently as students enter grades 4, 5, and 6. The study was conducted during the 1982-83 school year and, not surprisingly, little computer assisted instruction (CAI) was being used in science education at that time.

At the present time data are lacking which indicate how much or what types of science instruction take place in special education settings. Frith and Mitchell (1980) reported that there were no conclusive empirical data which addressed the efficacy of science education for mildly retarded students. To this day, we are still seeking such evidence. A few studies have been conducted which seem to indicated that various approaches to teaching science have been successful with special groups. Various process/inquiry-oriented approaches have been implemented successfully (Ball & Danglade, 1978; Wilson & Koran, 1973). Menhusen and Gromme (1976), in discussing curricula which were specifically designed for special groups (i.e., Me Now and Me and My Environment), reported that these materials had led to gains as well.

It is uncertain as to which approach to science instruction predominates in those special education classes where science is taught. Certain sources (Bindel, 1985; Price et al., 1982) report that a trend back to more traditional methods of science instruction (i.e., textbooks) is occurring in some areas of the country.

One of the most important concerns that can be immediately

identified from a cursory examination of the nature of science instruction in special education focuses on personnel preparation. Keller (1981) hit the nail on the head when she argued that for the most part special education teachers have little formal training in science and science teaching. This fact creates more concern when one realizes that at the secondary level special education personnel become subject area specialists who may be required to teach credit courses in science. This situation is compounded by the fact that a significant number of secondary level special education teachers in many states come from elementary backgrounds by virtue of the fact that special education certification is K-12. Even for those special education teachers who teach at the level of schooling for which they were prepared, there has been little emphasis on science in their training programs (Frith & Mitchell, 1980). Few general methods and curriculum courses offered in special education training programs address science and other curricular areas which do not fall under the umbrella of basic skills. If certain approaches to teaching science (e.g., inquiry-oriented programs like Elementary Science Study) are to be implemented appropriately, then a certain degree of training to do so seems warranted (Price et al., 1982).

The purpose of this paper is to examine the current status of science education within selected special education programs for mildly handicapped students. To achieve this goal, individuals currently teaching in special education were surveyed) regarding the nature of science in their curricula. Information was

collected in regard to the following areas: the frequency with which science is taught, the way it is taught, the training background of teachers, and the hindrances to instruction which teachers experience. The data obtained can begin to provide educators with a basis for formulating recommendations for current practice and future research.

METHOD

Participants

Responses to a curricular survey related to science instruction were sought from a geographically diverse group of special education teachers. All individuals were teaching students with mild disabilities (i.e., learning disabled, mildly retarded, emotionally disturbed/behavior disordered, or generically identified students). Participants were obtained from individual school divisions in one of two ways: (a) through selection by supervisory personnel or (b) from enrollment in graduate classes in special education. Participants represented the following states: Alabama, Indiana, Louisiana, New Mexico, Texas, Virginia, and Washington. Persons administering the survey were instructed to select participants who had a minimum of one year experience teaching mildly handicapped students. A total of 306 survey forms were returned. Forty-five percent of the participants indicated that they were teaching in programs which contained a mixture of students with different conditions; 29% taught only students with

learning disabilities; 15% only students with mild mental retardation; 6% only students with emotional/behavioral disorders, with the remainder (5%) teaching in various other situations.

Instrument and Procedures

The survey form used in this study was specifically developed for this research project. It was initially tested on a sample of respondents in higher education and then revised. The instrument requested respondents to identify current instructional positions according to: the type of students served, the school level where they taught, and the educational arrangement which they provided (e.g., two hours or less of daily instruction, half day instruction, or full day self-contained).

Participants were first asked to describe their current instructional situation by selecting one of these alternatives:

a. I am required to teach science as a content area as part of my regular responsibilities.

b. I am not required to teach science as part of my regular responsibilities but nevertheless teach it on a regular basis.

c. I am not required to teach science as part of my regular responsibilities and do not teach it on a regular basis.

Those who indicated either choice a or b were asked to respond to three specific questions about their science program, including the amount of time devoted per week, the program's curricular basis, and the teaching approaches regularly employed.

RESULTS

Data were summarized as frequencies of each response to each of the questions. Only those tabulations having the greatest relevance for instruction are highlighted here. Categorical variances were not analyzed due to the apparent similarity across areas of exceptionality.

The initial question posed on the survey concerned the general status of science within the individual respondent's curriculum according to the three options listed earlier. These data are summarized in Table 1 with differentiations identified according to the three specific service delivery models represented. Clearly the most significant findings relate to the virtual absence of science within the curriculum. of resource-type programs (two hours or less) and the inclusion of this subject area within approximately 62% of all full-time self-contained programs.

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insert Table 1 about here

Given the reduced time constraints, greater scheduling flexibility, and curricular structure common to full day self-contained type programs, the second analysis focused just on this educational arrangement across levels of schooling (i.e., school level) (see Table 2). While over 63% of the elementary teachers and 66% of the middle school/junior high teachers included science within the instructional programs of their students, only about half (51.2%) of the secondary teachers did.

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insert Table 2 about here

Table 3 summarizes data obtained only from those respondents who actually taught science. As can be seen in the Table, there was a relatively even distribution of the amount of time devoted to instruction with an approximate median amount of 60-120 minutes per week. The data on curricular orientation showed a variety of responses with more than one third indicating that they used a regular education curriculum; one fourth reported that they developed their own, combining various programs which were available. Finally, the third analysis in this table focused on instructional methodology use in conjunction with the various curricular materials. Respondents were asked to select the most accurate description of their teaching approach. With 42.9% indicating a combination of approaches, there appears to be a reasonable degree of eclecticism in instruction although again there is a relatively high degree of reliance on regular education textbooks (20.7%).

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insert Table 3 about here

All respondents were asked to select the best description of their training as it related to the teaching of science; these data are presented in Table 4. Without question the most significant finding was the fact that 42.5% reported no training at either the pre-service or in-service level.

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insert Table 4 about here

The final question posed to respondents concerned possible hindrances to science instruction. Participants were asked to rank order the three most significant factors which interfered with the inclusion of science within their overall curriculum. These data are summarized in Table 5.

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insert Table 5 about here

DISCUSSION

Perhaps it is not surprising to find that a significant percentage of special education personnel is not engaged in teaching science. Nearly 56% of the teachers surveyed do not teach this subject area while only 27% of the teachers who do are required to do so. To some extent this is explained by the fact that 48% of the respondents were not teaching in full day self-contained settings. Therefore, it can probably be assumed that in many cases their students are likely to be receiving some science instruction in regular education settings. This assumption is consistent with observational reports of current practice. Nevertheless it is interesting that a number of teachers in resource (2 hours or less) and half-day arrangements do teach science.

In regard to full day self-contained settings, there is an alarming finding. Nearly 38% of those teachers who identified

themselves as working in this type of arrangement do not teach science at all. It certainly seems defensible to argue that mildly handicapped students in these settings should be receiving such instruction. If systematic and instructionally sound science programs are to be found in special education, it is most likely that they will be located in these settings.

When the data are analyzed by level of schooling, we found that 49% of the secondary level teachers responding did not teach science. This could be explained by the fact that within the departmental nature of secondary programs, some teachers are not assigned to teach science since such instruction is provided by other special educators. Another possible explanation for this high percentage might be that the curricular programs of some secondary level students may have primarily a career/vocational and/or functional orientation, precluding an emphasis on formal science instruction. However there are those (Turnbull & Schilz, 1979) who persuasively have argued that science should be related to adult adjustment and community living skills and therefore part of students' programs. Certain programs with life skill orientations such as those discussed by Cronin and Gerber (1982) typically include components on health which is clearly a necessary life science topic.

One indication of the comprehensiveness of a science program is the amount of time allotted for such instruction. Over 50% of teachers engaged in instruction spend more than 60 minutes per week on science; this translates to approximately two 30-minute

sessions. Nearly half spend less than 60 minutes per week. As the data collected in this area are grouped and not analyzed according to the particular level of schooling, it is difficult to draw any firm conclusions. As presented earlier, Blindel (1985) reporting findings on regular science education indicated that instruction for grades K-3 ranges from 85 to 100 minutes per week across various states. For grades 4-6, he found that the range was 130 to 225 minutes per week. It appears that for the most part there is less time spent per week teaching science in full day self-contained special classrooms than there is in regular education. The common practice of alternating the teaching of science and social studies instruction throughout the weekly schedule may be a reason for this finding.

In the early 1970's, Boekel and Steele (1972) noted that many teachers had to develop their own science materials and methodology for special populations without the benefit of a specialized resources. Today, even though there are more options and some teachers are developing their own curricular materials, there is little indication that this is frequently happening in special settings based on the findings presented herein. As noted in Table 3(B), special education teachers are generally using regular education curricular sequences. The magnitude of this finding may even be greater if the category entitled "Combination of Programs" is investigated and related to the other categories. The percentage of teachers who solely rely on a regular education curriculum is 33.9% and jumps to 58.3% when those teachers who use

a combination of programs including a regular education curriculum are added to this category. While teachers at the elementary level are likely to base some of their instructional curriculum on both student interest and regular education programs, those who combine programs at the secondary level tend to rely on regular and special education curricular materials. Of note is the relatively infrequent use of only materials whether commercially produced or teacher constructed) which are specifically designed for handicapped students. The reasons why many special education teachers may use regular education programs and materials include: (a) the materials are available to them in the schools; (b) they are unfamiliar with the specialized materials that have been developed; and/or (c) they are uncomfortable with designing programs of their own. The problems associated with using regular education materials with special populations (e.g., readability) has been documented regularly by teachers in the field.

Frequently the approach(es) used to teach science is(are) related to the type of curricular orientation which has been adopted. For instance, many regular education programs utilize a textbook format, thus clearly requiring certain academic behaviors. Approximately 43% of the special education teachers who teach science uses some combination of instructional strategies. When the data on multiple approaches is related to the other data presented in Table 3(C), some interesting observations can be made. Fifty-eight percent of the respondents use a regular education text in some way. Forty-five percent incorporate "hands-on" activities

into their programs. This finding again highlights the probable availability and decision to use regular education texts while also reflecting-the fact that these materials have recently incorporated more on hands-on activities into them. Teters and colleagues (1984) in their report on regular science education found that most elementary teachers (ranging from 79 to 96% depending on grade level) used textbooks. Teachers from this same study indicated that most of them also utilized hands-on approaches as well (ranging from 80% to 92%). Clearly, hands-on activities are used much less often in special education classes which is unfortunate given the positive benefits of concrete and active learning experiences for children and youth who are disabled.

In looking at the results on training background, it is important to keep in mind that responses were obtained from all participants of the study (see Table 4). The most noteworthy finding in this area is that 42% of the teachers reported no training of any type. Thus it can be concluded that many of these teachers have never been exposed to the various methodologies of science education. Although many of these teachers may not now be teaching science, some are currently engaged in science education. This information encourages reconsideration of the training programs from which these teachers come. Only about 32% of the teachers said that they had ever taken a methods course of any type which addressed science education methodology; the chances of this happening in special education curriculum/methods courses is very slim. The small percentage associated with the in-service option

may be explained by the nature of the survey question. Subjects were asked to choose "the most appropriate response" and thus some responses may be masked by other choices. Nevertheless, a significant number of teachers have not even been exposed to this sometimes limited form of training as evidenced by the large number who indicated that they had received no training. The implications of these findings for teacher trainers and directors of inservice training are obvious.

As was to be expected, the major hindrances which teachers cited as interfering with the inclusion of science instruction in special education settings are insufficient materials and insufficient time. The first hindrance relates to the overall problem of using regular education materials with special populations. From earlier data discussed above, we know that many teachers solely or at least primarily use regular education materials. The second hindrance is associated with the reality of scheduling. Teachers in resource settings do not have the time to devote to subject areas such as science. Other hindrances reported under the "other" category included: inadequate space, mixed ability levels within same classroom, and inclusion of other curricular objectives in students' program in place of science. Teters and associates (1984) stated that the two most frequently cited hindrances which they found in regular science education were lack of supplies and scarcity of laboratory space.

CONCLUSION

The value of science instruction for students with mild disabilities can be argued for some of the same reasons that it would be for students who are not disabled. The fact that students can be actively involved in their learning and that critical thinking and problem solving skills can be developed are strong reasons for including this subject area in the curriculum. Science programs need to be flexible and relevant to the subsequent life needs of the students. They also need to be coordinated with the curricula of regular science education if we want to move students from, special education to regular education. The fact that resource teachers usually do not teach science per se does not mean that they cannot coordinate their efforts (e.g., vocabulary development) with those of the science teacher. Committees should be formed as suggested by Turnbull and Schulz (1979) to analyze the science curriculum and identify content and concepts which are relevant and necessary for adult adjustment and living. The data on training background presented in this study lead us to strongly encourage a review of preservice and inservice training programs. Students with special needs will be better served if those who are teaching them are better prepared.

Several limitations inherent in this study must be noted. The respondents who participated in this study cannot be assumed to be representative of all special education teachers working in the field. Although the sample was clearly diverse, there was no

attempt to select a nationally representative group nor were the subjects randomly selected. Moreover, the survey data examined and the type of questions considered are only a few of many possible topics worthy of consideration. As a result, other important questions were not addressed in this study. These limitations must be recognized and any conclusions drawn from these data must be subject to careful interpretation. However the data presented and discussed .,in this study serve two major purposes: (1) they add to the knowledge base which currently exists concerning science education for students with mild disabilities and (2) they suggest critical topics that must be addressed in subsequent curriculum development efforts.

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Table 1

SCIENCE INSTRUCTION

Service Delivery Model	Science in Curriuclum Required	Chose to Teach	Not Taught
2 hours or less (N=100)	5%	12%	83%
Half day instructional program (N=41)	19	15	66
Full day self-contained (N=141)	46	16	38

Table 2

Science Instruction:
Teaching Situation Within Full Day Program

	Science in Curriculum		
	Required	Chose to Teach	Not Taught
Elementary Level (N=58)	48%	16%	36%
Middle School/Junior High Level (N=34)	56	21	23
Secondary Level (N=43)	37	14	49

Table 3
Nature of Science Instruction[a, b]

A. Minute/Week	
0-30	24 (18.8)
30-60	36 (28.1)
60-120	27 (21.1)
120-180	9 (7.0)
180+	32 (25.0)
B. Curricular Basis[c]	
Assessment of Student Interests	19 (15.0)
Regular Education Curriculum	43 (33.9)
Commercial Special Education Curriculum	20 (15.7)
Other Non-Commercial Curriculum Designed for Handicapped Students	5 (3.9)
Combination of Programs	32 (25.2)
Other	8 (6.3)
C. Science Instructional Approaches[c]	
Regular Education Text	26 (20.7)
Special Education Text	16 (12.7)
Special Education Curriculum Sequence	9 (7.1)
Discovery/Experimentation	16 (12.7)
Computer Simulations	1 (.8)
Combination of Approaches	54 (42.9)
Other	4 (3.2)

[a] Includes only those who indicated they taught science

[b] Percentages are in parentheses

[c] Participants listing more than one response are under the "combination" designation; other responses indicate sole reliance on this approach or curricular orientation

Table 4
Training Background

Undergraduate Degree in Science	17	(6.0)
Regular Education Science Methods	78	(27.7)
Special Education Science Methods	12	(4.3)
Unit Within a Methods Course	15	(5.3)
In-Service/Workshop	5	(1.8)
Multiple Training Experiences	28	(10.0)
Other	9	(2.8)
No Training	119	(42.2)

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[a]Other than coursework for general college degree requirement

[b]Analyses for teahers with no training at various school levels -- elementary: 38%; middle/junior high: 47%; secondary: 38%

Table 5
Instructional Hindrances

Concern	Total Number of Respondents Selecting Item	1	2	3	Index of Hindrance
Content Irrelevant	116 (37.9)	64	25	28	.88
Insufficient Time	128 (41.9)	85	30	13	1.07
Insufficient Materials	159 (52.0)	70	63	26	1.18
Inadequate Training	68 (22.2)	12	25	31	.38
Lack of Administrative Support	17 (5.6)	1	4	12	.08
Other (varied responses)	67 (21.9)	36	19	12	--d

[a]Participants were asked to rank order the three most significant problems encountered.

[b]Percentages for respondents selecting the item are in parentheses.

[c]Ranging in value from 0.0 (low) to 3.0 (high), this figure reflects how significant a hindrance each concern is; index equals the sum of the weighted rankings divided by total number of subjects (N=306).

[d]As this category included a myriad of different individual responses, no index was calculated.